

AMENDMENTS TO THE CLAIMS

The following Listing of Claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

Claim 1 (previously presented): A method of forming an infrared detectable mark on a substrate comprising:

forming the mark on the substrate using a laser marking system and a laser marking composition comprising an infrared reflective inorganic pigment, wherein the infrared reflective inorganic pigment causes the mark to reflect radiation at a predetermined wavelength within the range of from about 0.75 μ m to about 40 μ m at a sufficiently different level than the substrate adjacent to the mark such that the mark can be discerned from the substrate at the predetermined wavelength; and

applying a cover coating material comprising an inorganic pigment that is different than the infrared reflective inorganic pigment in the laser marking composition over the mark and over at least a portion of the substrate adjacent to the mark to form a cover coat, wherein the cover coat is in the form of a film selected from the group consisting of paint films, porcelain enamel coating films, glass enamel coating films, extruded plastic films and laminated plastic films, wherein the cover coat appears substantially opaque in the visible portion of the electromagnetic spectrum such that it conceals the mark covered by the cover coat in the visible portion of the electromagnetic spectrum but is sufficiently transmissive of radiation emitted at the predetermined wavelength such that the mark can be discerned from the substrate through the cover coat at the predetermined wavelength.

Claim 2 (original): The method according to claim 1 wherein the substrate is a surface of a part for installation in a land vehicle or aircraft.

Claim 3 (original): The method according to claim 1 wherein the substrate is a primer coat layer applied to a surface of an article.

Claim 4 (cancelled)

Claim 5 (previously presented): The method according to claim 1 wherein the infrared reflective inorganic pigment is one or more selected from the group consisting of:

$\text{Mn}_2\text{V}_2\text{O}_7$;

$\text{M1}_x\text{MnO}_y$, where M1 is calcium, strontium, barium, magnesium, yttrium and/or an element selected from the Lanthanide series of the Periodic Table of the Elements, x is a number from about 0.01 to about 99, and y is greater than or equal to X+1 and less than or equal to X+2 and designates the number of oxygen atoms required to maintain electroneutrality;

$\text{Bi}_2\text{Mn}_4\text{O}_{10}$;

solid solutions having a corundum-hematite crystalline structure comprising iron oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, chrome, cobalt, gallium, indium, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc; and

solid solutions having a corundum-hematite crystalline structure comprising chrome oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, cobalt, gallium, indium, iron, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc.

Claim 6 (original): The method according to claim 1 wherein the average particle size of the inorganic pigment in the cover coating material is from about 0.02 μm to about 15 μm .

Claim 7 (original): The method according to claim 1 wherein the average particle size of the inorganic pigment in the cover coating material is from about 0.1 μm to about 0.5 μm .

Claims 8-10 (cancelled)

Claim 11 (original): The method according to claim 1 wherein the mark is in the form of a machine-readable code.

Claim 12 (original): The method according to claim 1 wherein the inorganic pigment in the cover coating material is doped with one or more elements such that the inorganic pigment provides a uniquely identifiable spectral curve.

Claim 13 (original): The method according to claim 1 wherein the cover coating material comprises two or more different inorganic pigments that together provide a uniquely identifiable spectral curve.

Claim 14 (previously presented): A method of forming an infrared detectable mark on a substrate comprising:

applying a marking material comprising an infrared reflective inorganic pigment to the substrate to form the mark;

applying a contrast marking material to the substrate to form a contrast mark proximal to the mark, wherein the infrared reflective inorganic pigment causes the mark to reflect radiation at a predetermined wavelength within the range of from about 0.75 μm to about 40 μm at a sufficiently different level than the contrast mark such that the mark can be discerned from the

contrast mark at the predetermined wavelength, wherein at least one of the mark and the contrast mark is formed using a laser marking system; and

applying a cover coating material comprising an inorganic pigment that is different than the infrared reflective inorganic pigment in the marking material over the mark and the contrast mark to form a cover coat, wherein the cover coat is in the form of a film selected from the group consisting of paint films, porcelain enamel coating films, glass enamel coating films, extruded plastic films and laminated plastic films, wherein the cover coat appears substantially opaque in the visible portion of the electromagnetic spectrum such that it conceals both the mark and the contrast mark covered by the cover coat in the visible portion of the electromagnetic spectrum but is sufficiently transmissive of radiation emitted at the predetermined wavelength such that the mark can be discerned from the contrast mark through the cover coat at the predetermined wavelength.

Claim 15 (original): The method according to claim 14 wherein the substrate is a surface of an article.

Claim 16 (original): The method according to claim 14 wherein the substrate is a base coat layer applied to a surface of an article.

Claim 17 (cancelled)

Claim 18 (previously presented): The method according to claim 14 wherein the infrared reflective inorganic pigment is one or more selected from the group consisting of:

$\text{Mn}_2\text{V}_2\text{O}_7$;

$M_{1-x}MnO_y$, where M1 is calcium, strontium, barium, magnesium, yttrium and/or an element selected from the Lanthanide series of the Periodic Table of the Elements, x is a number from about 0.01 to about 99, and y is greater than or equal to X+1 and less than or equal to X+2 and designates the number of oxygen atoms required to maintain electroneutrality;

$Bi_2Mn_4O_{10}$;

solid solutions having a corundum-hematite crystalline structure comprising iron oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, chrome, cobalt, gallium, indium, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc; and

solid solutions having a corundum-hematite crystalline structure comprising chrome oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, cobalt, gallium, indium, iron, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc.

Claim 19 (original): The method according to claim 14 wherein the average particle size of the inorganic pigment in the cover coating material is from about 0.02 μm to about 15 μm .

Claim 20 (original): The method according to claim 14 wherein the average particle size of the inorganic pigment in the cover coating material is from about 0.1 μm to about 0.5 μm .

Claim 21 (original): The method according to claim 14 wherein the substrate is selected from the group consisting of metal, glass, wood, plastic and ceramic.

Claims 22 and 23 (cancelled)

Claim 24 (original): The method according to claim 14 wherein the mark is in the form of a bar code.

Claim 25 (original): The method according to claim 14 wherein the inorganic pigment in the cover coating material is doped with one or more elements such that the inorganic pigment provides a uniquely identifiable spectral curve.

Claim 26 (original): The method according to claim 14 wherein the cover coating material comprises two or more different inorganic pigments that together provide a uniquely identifiable spectral curve.

Claim 27 (previously presented): The method according to claim 14 wherein the contrast marking material comprises an infrared reflective inorganic pigment that is different from the infrared reflective organic pigment in the marketing material.

Claim 28 (previously presented): The method according to claim 27 wherein the infrared reflective inorganic pigment in the contrast marking material is one or more selected from the group consisting of:

$\text{Mn}_2\text{V}_2\text{O}_7$;

$\text{M1}_x\text{MnO}_y$, where M1 is calcium, strontium, barium, magnesium, yttrium and/or an element selected from the Lanthanide series of the Periodic Table of the Elements, x is a number from about 0.01 to about 99, and y is greater than or equal to $X+1$ and less than or equal to $X+2$ and designates the number of oxygen atoms required to maintain electroneutrality;

$\text{Bi}_2\text{Mn}_4\text{O}_{10}$;

solid solutions having a corundum-hematite crystalline structure comprising iron oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, chrome, cobalt, gallium, indium, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc; and

solid solutions having a corundum-hematite crystalline structure comprising chrome oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, cobalt, gallium, indium, iron, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc.

Claim 29 (previously presented): A method of forming an infrared detectable mark on a substrate comprising:

applying a marking material comprising an infrared reflective inorganic pigment to the substrate to form the mark;

applying a masking material over a least a portion of the mark and, optionally, over a portion of the substrate, to form a mask, wherein the infrared reflective inorganic pigment causes the mark to reflect radiation at a predetermined wavelength within the range of from about 0.75 μ m to about 40 μ m at a sufficiently different level than the mask such that the mark can be discerned from the mask at the predetermined wavelength, wherein at least one of the mark and the mask is formed using a laser marking system; and

applying a cover coating material comprising an inorganic pigment that is different than the infrared reflective inorganic pigment in the marking material over the mark and the mask to form a cover coat, wherein the cover coat is in the form of a film selected from the group consisting of paint films, porcelain enamel coating films, glass enamel coating films, extruded plastic films and laminated plastic films, wherein the cover coat appears substantially opaque in the visible portion of the electromagnetic spectrum such that it conceals both the mark and the mask covered by the cover coat in the visible portion of the electromagnetic spectrum but is sufficiently transmissive of radiation emitted at the predetermined wavelength such that the mark can be discerned from the mask through the cover coat at the predetermined wavelength.

Claim 30 (original): The method according to claim 29 wherein the substrate is a surface of an article.

Claim 31 (original): The method according to claim 29 wherein the substrate is a base coat layer applied to a surface of an article.

Claim 32 (cancelled)

Claim 33 (currently amended): The method according to claim ~~32~~ 29 wherein the infrared reflective inorganic pigment is one or more selected from the group consisting of:

$\text{Mn}_2\text{V}_2\text{O}_7$;

$\text{M1}_x\text{MnO}_y$, where M1 is calcium, strontium, barium, magnesium, yttrium and/or an element selected from the Lanthanide series of the Periodic Table of the Elements, x is a number from about 0.01 to about 99, and y is greater than or equal to X+1 and less than or equal to X+2 and designates the number of oxygen atoms required to maintain electroneutrality;

$\text{Bi}_2\text{Mn}_4\text{O}_{10}$;

solid solutions having a corundum-hematite crystalline structure comprising iron oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, chrome, cobalt, gallium, indium, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc; and

solid solutions having a corundum-hematite crystalline structure comprising chrome oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, cobalt, gallium, indium, iron, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc.

Claim 34 (original): The method according to claim 29 wherein the average particle size of the inorganic pigment in the cover coating material is from about 0.02 µm to about 15 µm.

Claim 35 (original): The method according to claim 29 wherein the average particle size of the inorganic pigment in the cover coating material is from about 0.1 µm to about 0.5 µm.

Claim 36 (original): The method according to claim 29 wherein the substrate is selected from the group consisting of metal, glass, wood, plastic and ceramic.

Claims 37 and 38 (cancelled)

Claim 39 (original): The method according to claim 29 wherein the mark is in the form of a bar code.

Claim 40 (original): The method according to claim 29 wherein the inorganic pigment in the cover coating material is doped with one or more elements such that the inorganic pigment provides a uniquely identifiable spectral curve.

Claim 41 (original): The method according to claim 29 wherein the cover coating material comprises two or more different inorganic pigments that together provide a uniquely identifiable spectral curve.

Claim 42 (previously presented): The method according to claim 29 wherein the masking material comprises an infrared reflective inorganic pigment that is different than the infrared reflective inorganic pigment in the marking material.

Claim 43 (previously presented): The method according to claim 42 wherein the infrared reflective inorganic pigment in the masking material is one or more selected from the group consisting of:

$\text{Mn}_2\text{V}_2\text{O}_7$;

$\text{M1}_x\text{MnO}_y$, where M1 is calcium, strontium, barium, magnesium, yttrium and/or an element selected from the Lanthanide series of the Periodic Table of the Elements, x is a number from about 0.01 to about 99, and y is greater than or equal to X+1 and less than or equal to X+2 and designates the number of oxygen atoms required to maintain electroneutrality;

$\text{Bi}_2\text{Mn}_4\text{O}_{10}$;

solid solutions having a corundum-hematite crystalline structure comprising iron oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, chrome, cobalt, gallium, indium, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc; and

solid solutions having a corundum-hematite crystalline structure comprising chrome oxide a host component doped with guest elements selected from aluminum, antimony, bismuth, boron, cobalt, gallium, indium, iron, lanthanum, lithium, magnesium, manganese, molybdenum, neodymium, nickel, niobium, silicon, tin, titanium, vanadium and zinc.

Claim 44 (previously presented): A non-visible authentication mark comprising a laser mark disposed between a substrate and a cover coating layer that covers the laser mark and at least a portion of the substrate surrounding the laser mark, wherein the laser mark comprises an infrared reflective inorganic pigment and the cover coating layer comprises an inorganic pigment that is different than the infrared reflective inorganic pigment in the laser mark, wherein the cover coating layer is in the form of a film selected from the group consisting of paint films, porcelain enamel coating films, glass enamel coating films, extruded plastic films and laminated plastic films, wherein the infrared reflective inorganic pigment in the laser mark causes the laser mark to

reflect radiation at a predetermined wavelength within the range of from about 0.75 μm to about 40 μm at a sufficiently different level than the substrate covered by the cover coating layer, and wherein the cover coating layer appears substantially opaque in the visible portion of the electromagnetic spectrum such that it conceals the laser mark covered by the cover coat in the visible portion of the electromagnetic spectrum but is sufficiently transmissive of radiation emitted at the predetermined wavelength that the laser mark can be discerned from the substrate through the cover coating layer at the predetermined wavelength.

Claim 45 (previously presented): An article marked with a non-visible authentication mark comprising a laser mark disposed between a surface of the article and a cover coating layer that covers the laser mark and at least a portion of the substrate surrounding the laser mark, wherein the laser mark comprises an infrared reflective inorganic pigment and the cover coating layer comprises an inorganic pigment that is different than the infrared reflective inorganic pigment in the laser mark, wherein the cover coating layer is in the form of a film selected from the group consisting of paint films, porcelain enamel coating films, glass enamel coating films, extruded plastic films and laminated plastic films, wherein the infrared reflective inorganic pigment in the laser mark causes the laser mark to reflect radiation at a predetermined wavelength within the range of from about 0.75 μm to about 40 μm at a sufficiently different level than the surface of the article beneath the cover coating adjacent to the laser mark, and wherein the cover coating layer appears substantially opaque in the visible portion of the electromagnetic spectrum such that it conceals the laser mark covered by the cover coat in the visible portion of the electromagnetic spectrum but is sufficiently transmissive of radiation emitted at the predetermined wavelength that the laser mark can be discerned from the surface of the article beneath the cover coating adjacent to the laser mark through the cover coating layer at the predetermined wavelength.